

**REMARKS**

An excess claim fee payment is submitted herewith for one (1) excess total claim.

Claims 1-27 are all the claims presently pending in the application. Claims 3 and 4 have been amended to more particularly define the invention. Claim 27 has been added to claim additional features of the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

The Examiner has requested, under 37 CFR §1.105, test data that demonstrates the actual and real operation of the claimed invention. Accordingly, two documents are submitted in the attachment hereto. The first document describes the qubit configuration of the present invention, relative to flux qubits reported as having already been demonstrated. The second document subsequently reported actual test results with a version of this qubit.

Applicants gratefully acknowledge Examiner Hirl for taking time on May 23, 2007, for conducting a personal interview with Applicants' representative and on June 20, 2007, for conducting a telephone interview including inventor Koch. In both interviews, Applicants explained that the present invention differs from the cited prior art reference Pitman in that the present invention is directed to a flux qubit using a transmission line to intercommunicate with the qubit. The Examiner indicated that he considered the invention as not having been actually reduced to practice without having documentation, such as test data, that demonstrates that the qubit circuit had actually been achieved.

Accordingly, based on the Examiner's various requests, Applicants attach two

publications that were published subsequent to the filing date of the present application and that further describe the claimed invention. The first, earlier document describes in more detail the qubit upon which the transmission line technique was used (see third paragraph on first page), along with statements concerning the demonstration of earlier flux qubits for which the present invention can be used (see first paragraph on first page). The second document describes actual testing of a version of the present invention, exemplarily using an oscillator-stabilized Josephson qubit.

Applicants believe that these two articles satisfy the Examiner's requirement for additional information under 37 CFR §1.105.

Claims 1-26 stand rejected under 35 U.S.C. § 101, as allegedly being nonstatutory subject matter. Claims 1-26 stand rejected under 35 U.S.C. § 101, as allegedly lacking patentable utility. Claims 1-26 stand rejected under 35 U.S.C. § 112, first paragraph, as a rejection concurrent with the nonstatutory subject matter rejection and as failing to comply with the written description. Claim 23 stands rejected under 35 U.S.C. § 102(e), as anticipated by US Patent Application Publication 2003/0086138 to Pitman et al.

These rejections are respectfully traversed in the following discussion.

## **I. THE CLAIMED INVENTION**

As described, for example, in independent claim 1, the claimed invention is directed to a method of coupling a qubit. The qubit is located near a transmission line approximately at a location corresponding to a node at a predetermined frequency.

As described beginning at line 4 on page 2 of the specification, a fundamental problem with the development of qubits is that of isolating a qubit from the environment.

The claimed invention, on the other hand, takes the novel approach of locating the qubit at a node in the transmission line used to intercommunicate with the qubit, which is a

location along the transmission line based on the basic operating frequency of the qubit.

## **II. THE 35 USC §101 REJECTION**

Claims 1-26 stand rejected under 35 U.S.C. §101 as allegedly directed toward nonstatutory subject matter. Applicants understand that this rejection is based upon the Examiner's requirement that Applicants submit additional documentation concerning actual implementation of the claimed invention. This additional documentation is attached hereto.

However, Applicants submit that this rejection appears to be somewhat misplaced, since a qubit is an apparatus, thereby clearly falling within one of the four categories of 35 USC §101. The method claims are directed to efficiently coupling to the qubit, a problem that has plagued the art relative to effective qubit development. Applicants respectfully submit that coupling to a qubit is, contrary to the Examiner's implication, inherently a "real world" application, given the qubit and transmission line as being real-world components.

Relative to the concern that the present invention is preempting an idea, law of nature, or natural phenomena, Applicants respectfully submit that the present invention is clearly directed to a qubit that relies upon a transmission line for interactions. The claims are directed to a circuit involving a qubit as located at a specific location on that transmission line and a method of more efficient coupling to the qubit. Therefore, the claims are not directed to an abstract idea, law of nature or natural phenomena. The claims do not even address the circuit in which the qubit is located at any other location on that transmission line or to any other qubit designs that do not incorporate a transmission.

Relative to the concern that the present invention lacks utility, Applicants point out that improved efficiency in coupling to a qubit would inherently be useful. Part of the Examiner's confusion appears to due to the Examiner's attempt to consider the flux qubit used exemplarily to describe the present invention as equivalent to the photon-based qubit of

the cited prior art reference. As explained in the second above-mentioned interview, the present invention operates at a lower frequency from that of the qubit described in Pitman.

Relative to the concern that the disclosure allegedly did not describe the qubit in sufficient detail to be considered anything except merely a mathematical object that does not represent something that is real rather than abstract, Applicants submit that the present invention is primarily directed to the location of a qubit relative to the transmission line, in a manner that reduces decoherency. The actual construction of the qubit itself is presumed to be any of various flux qubits discussed briefly at lines 11-18 of page 9 of the specification, as further described in the first of the two attachment documents submitted in response to the Examiner's requirement for additional documentation under 37 CFR §1.105. This first document explains that flux qubits have been demonstrated (see first paragraph on front page) and then explains in the third paragraph the experimental realization of a qubit for demonstrating the concept of the claimed invention. The second document demonstrates the test set up and provides experimental results.

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

### **III. THE 35 USC §112, FIRST PARAGRAPH REJECTION**

Claims 1-26 stand rejected under 35 U.S.C. §112, first paragraph. As best understood, the Examiner considers that the description in the specification fails to demonstrate that the inventors had possession of the claimed invention and/or that one having ordinary skill in the art would not be able to replicate the invention.

In response, Applicants again point out that the present invention is primarily directed to the location of a qubit (e.g., a flux qubit) along a transmission line used to communicate with the qubit, not to the details of the construction of the qubit. The capability of the present

invention to reduce decoherence of a qubit has been a problem in developing an effective qubit, as explained beginning at line 4 on page 2 of the specification. Applicants believe that the method of the present invention, of locating the qubit along the transmission line, would be easily achieved by one having ordinary skill in the art after reading the present application.

The specific qubit exemplarily discussed in the present application involves a flux qubit (see line 16 of page 9), known in the art at the time of the invention as being a design based on Josephson junctions. These qubit designs had been demonstrated at the time of the present invention, as confirmed by the description the first paragraph of the attached paper dated in 2004, referring to cited references [2] and [3] identified at the end of the paper. These cited articles date back to 1999, clearly demonstrating that any of a number of specific flux qubit designs could have been used to implement the present invention, as related to the location of the qubit along a transmission line. Moreover, the third paragraph on the first page of this paper describes an exemplary structure of a qubit configuration for the present invention, using a transmission line tuned to 1.54 GHz for coupling to the qubit.

It is again noted that, contrary to the implication in the rejection, the present invention is not so much directed to construction details of any one of these potential flux qubit designs. Rather, the contribution to the art of the present invention is the placement of one of these flux qubit designs at a specific location along the transmission line used to communicate with the flux qubit.

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

#### **IV. THE PRIOR ART REJECTION**

The Examiner alleges that Pitman teaches the claimed invention described in claim

23. Applicants respectfully disagree.

First, it is noted that this claim is drafted in means-plus-function format. Therefore, the prior art evaluation is confined to the equivalents of the structures and methods disclosed in the instant disclosure.

As explained in the two above-mentioned interviews, Pitman is not a flux qubit having a transmission line for coupling. Therefore, there are no structures or methods in Pitman that correspond to those described in the claims of the present invention.

Therefore, Applicants submit that there are elements of the claimed invention that are not taught or suggested by Pitman. Therefore, the Examiner is respectfully requested to withdraw this rejection.

#### **V. FORMAL MATTERS AND CONCLUSION**


In view of the foregoing, Applicant submits that claims 1-27, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

Serial No. 10/782,811  
Docket No. YOR920030615US1 (YOR.507)

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assignee's Deposit Account No. 50-0510.

Respectfully Submitted,



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Frederick E. Cooperrider  
Registration No. 36,769

**McGinn Intellectual Property Law Group, PLLC**  
8321 Old Courthouse Road, Suite 200  
Vienna, VA 22182-3817  
(703) 761-4100  
**Customer No. 21254**